

TONER SUPPLYING CONTAINER AND IMAGE FORMING APPARATUS

BACKGROUND OF THE INVENTION

Field of the Invention

5 The invention relates to a toner supplying container detachably attachable to a main body of an image forming apparatus such as a copying machine, a printer or a facsimile apparatus using an electrophotographic process or an electrostatic
10 recording process, and an image forming apparatus supplied with a toner from the toner supplying container.

Description of the Related Art

 A conventional image forming apparatus capable
15 of recording in a plurality of colors has been as follows.

 It will hereinafter be described with reference to Fig. 3 of the accompanying drawings. Fig. 3 is a perspective view of a rotary member.

20 The image forming apparatus has a so-called rotary type developing apparatus having a plurality of developing means (hereinafter referred to as the developing devices 52) and containers (hereinafter referred to as the toner bottles 15) containing
25 therein a plurality of developers (hereinafter referred to as the toners) corresponding thereto circumferentially disposed in a cylindrical rotary

member 51.

The reference numeral 51 designates the entire rotary member, the reference numeral 52 denotes the developing devices (of which only 52y is shown), and
5 the reference numeral 15 designates the toner bottles (of which only 15c and 15y are shown). In the present example, there are held the developing devices and toner bottles of three colors, i.e., magenta (suffix m), cyan (suffix c) and yellow
10 (suffix y).

The rotary member 51 is rotated to oppose a developing device 52 of a desired color to a photosensitive member (not shown), thereby visualizing a latent image on the photosensitive
15 member with a toner.

When the toners become exhausted, a user interchanges the toner bottles 15 to thereby supplement.

The rotary member 51 is rotatably held in an
20 apparatus main body (not shown), and has its rotation stoppage controlled at a desired rotational angle and speed by the use of a motor (not shown) provided in the apparatus main body.

The toner bottles 15 are provided with
25 operating levers (hereinafter referred to as the bottle knobs) 1 (1m, 1c, 1y), and by these bottle knobs being operated, the toner bottles 1 can be

fixed/released relative to the rotary member 51.

The toner bottles are inserted and removed in the direction of the rotary shaft of the rotary member (the direction of arrow A in Fig. 3).

5 The surrounding portions of the toner bottle interchanging portion of the apparatus main body will now be described with reference to Fig. 4 of the accompanying drawings.

10 The reference numeral 11 designates the apparatus main body, and the reference numeral 12 denotes an opening for interchanging the toner bottles therethrough.

15 When the toners become exhausted during an image forming operation, the apparatus discontinues image forming and calls upon the user to interchange the toner bottle 15 by a message or the like to the display of an operating portion.

20 The user opens the front cover (not shown) of the apparatus and has access to the opening portion 12. He rotates the bottle knob 1 by a predetermined angle to thereby release the toner bottle 15 from the rotary member 51. Then, he draws out the toner bottle 15 toward this side of the apparatus.

25 Even in an apparatus having toner bottles of a plurality of colors, the number of the opening for interchanging the toner bottles therethrough is one.

This is because in the actually used state of

the apparatus, it is rare that the toners of a plurality of colors become exhausted at a time.

Further, if a plurality of interchange doors are provided, it will become possible for the user to
5 have access to the plurality of toner bottles and therefore, the bottle to be interchanged will be difficult to recognize. Consequently, it is more advantageous to the user that a toner bottle in which the toner has become exhausted waits in the opening
10 portion.

The toner bottle will now be described with reference to Figs. 5A and 5B of the accompanying drawings. Fig. 5A is a front view of the toner bottle. Fig. 5B is a perspective view of a portion
15 of the toner bottle.

The reference numeral 2 designates a toner containing portion, and the reference numeral 3 denotes a shutter. The letter S designates a reflection type sensor provided in the apparatus main
20 body, and the reference character 1a denotes a reflecting surface for reflecting light emitted from the sensor.

The bottle knob 1 has a rotary shaft parallel to the rotary shaft of the rotary member 51, and the
25 bottle knob 1 is rotated by a predetermined amount to thereby fix or release the toner bottle 15 relative to the rotary member 51. Simultaneously therewith,

the opening and closing of the shutter 3 provided in the communicating portion between the toner bottle 15 and the developing device 52, or between the toner bottle and an intermediate hopper portion (not shown) are also effected (see Japanese Patent Application Laid-Open No. H11-194600).

The shutter 3 is opened when the toner bottle 15 is fixed, and is closed when the toner bottle 15 is released.

10 The intermediate hopper portion is a region having the function of once storing therein the toner from the toner bottle 15 and feeding a desired amount of it into the developing device 52.

15 The reflecting surface 1a is provided on the side surface (circumference) of the bottle knob 1, and the reflection type sensor S is installed so as to detect toward the center of rotation of the bottle knob 1.

20 When the user rotates the bottle knob 1, the reflecting surface 1a comes off from the detection area of the sensor S, whereby it can be detected that the user has rotated the bottle knob 1 or that the bottle is in its drawn-out state.

25 The following problems arise in a case where as shown in the conventional art, the reflecting surface is provided on the side surface (circumference) of the bottle knob 1 and the reflection type sensor S is

installed so as to detect toward the center of rotation of the bottle knob 1.

- The detecting surface of the reflection type sensor S is near to such portions handling the toner as the shutter 3 and the developing device 52 and therefore, faulty detection due to toner stains is liable to be caused.

- If the reflecting surface 1a is present on the side surface of the rotary member 51, when the rotary member 51 is rotated or stopped, one of the reflecting surfaces 1a of the plurality of toner bottles 15 will be stopped while facing substantially upwardly without fail and therefore, the toner is liable to accumulate thereon, and this is liable to cause faulty detection.

- When the detecting surface of the reflection type sensor S is stained, to clean it, it is necessary to detach a single piece of the sensor or the sensor unit from the apparatus main body, and this leads to a bad working property.

- Usually, after the toner bottle 15 has been interchanged, the user enters the recovery operation of rotating the rotary member several times or rotating the photosensitive member. However, judgment as to whether the toner bottle 15 has been interchanged can be effected only by a front cover opening-closing detection signal (usually the front

cover is provided with a sensor for detecting the opening and closing thereof) and therefore, when the user has opened and closed the front cover for some reason or other without interchanging the toner
5 bottle, the user performs the recovery operation in spite of the toner bottle 15 having not been interchanged.

This will hereinafter be described with the user's operation and the detection signal made to
10 correspond to each other. First comes the description of a normal procedure.

(1) The toner becomes exhausted during the image forming operation, and image forming is discontinued and therefore, the user is called upon
15 to interchange the toner bottle 15 by a message displayed on an operating portion.

(2) The user opens the front cover of the apparatus (not shown).

(3) The user starts the interchange of the
20 toner bottle 15 with reference to an interchanging method or the like on the display of the operating portion.

(4) The user rotates the bottle knob 1 by a predetermined angle to thereby release the toner
25 bottle 15 from the rotary member 51.

(5) The user draws out the toner bottle toward this side of the apparatus.

(6) The user inserts a new toner bottle 15.

(7) The user rotates the bottle knob 1 by a predetermined angle and fixes it.

(8) The user closes the front cover.

5 Movements in the image forming apparatus corresponding thereto are as follows.

(1) When the toner becomes exhausted during the image forming operation, the apparatus discontinues image forming, and calls upon the user
10 to interchange the toner bottle 15 by a message to the display of the operating portion.

(2) A sensor signal for opening the front cover is detected.

(3) In response to the signal, the display of
15 the operating portion is changed over to the display of the interchanging procedure.

(4) to (6) (There is no change during the user's interchange of the bottle.)

(7) The sensor S receives reflected light from
20 the reflecting surface 1a to thereby detect the fixing of the bottle. In response to the signal, the display of the operating portion is changed over to display for calling upon the user to close the front cover.

25 (8) The closing of the front cover is detected, and the display of the operating portion is returned to the ordinary display. The recovery sequence is

started, and after it is completed, image forming is resumed.

An example of the user's abnormal action will now be described.

5 (1) The toner becomes exhausted during the image forming operation, and image forming is discontinued, the user is called upon to interchange the toner bottle 15 by a message on the display of the operating portion.

10 (2) The user opens the front cover of the apparatus (not shown).

(3) However, he becomes aware that he has prepared a toner bottle of a wrong color, and again closes the front cover.

15 (4) He has prepared a right bottle, but cannot immediately interchange with it because the apparatus is in operation.

(5) Toner absence is again displayed and the interchange of the toner bottle is resumed
20 (thereafter, normal action takes place).

The movements in the image forming apparatus corresponding thereto are as follows.

(1) When the toner becomes exhausted during the image forming operation, the apparatus
25 discontinues image forming, and calls upon the user to interchange the toner bottle 15 by a message or the like to the display of the operating portion..

(2) A sensor signal for opening the front cover is detected.

(3) A signal for closing the front cover is again detected, and it is judged that the toner
5 bottle has been interchanged, and the display of the operating portion is returned to the ordinary display.

(4) The recovery operation is started. After it is completed, image forming is resumed.

(5) Image forming is resumed, but the toner
10 bottle has not been interchanged and therefore, toner absence is immediately displayed.

If as described above, only the detection of the opening and closing of the front cover is used as a judgment signal for the interchange of the bottle,
15 when the user performs abnormal action, the display of the operating portion is returned to the ordinary display or the recovery operation is repeated many times, in spite of the toner bottle having not been interchanged.

20 To solve this, it is conceivable to discretely provide detecting means capable of detecting the presence or absence of the toner bottle itself, but this will result in the rise of the cost of the apparatus and the complication of the apparatus, and
25 is not advisable.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a toner supplying container of which the opening and closing of the shutter can be detected.

It is another object of the present invention
5 to provide a toner supplying container of which both of the presence or absence of the mounting and the opening and closing of the shutter can be detected.

It is another object of the present invention to provide a toner supplying container detachably
10 mountable to the main body of an image forming apparatus for supplying a toner, and having a container body for containing the toner therein, a toner discharging port provided in the container body, a shutter for opening and closing the toner
15 discharging port, and a portion to be detected provided at a location corresponding to an optical sensor provided in the image forming apparatus for detecting the position of the shutter.

It is another object of the present invention
20 to provide an image forming apparatus in which the stain of an optical sensor for detecting the opening and closing of the shutter of a toner supplying container can be reduced as much as possible.

It is another object of the present invention
25 to provide an image forming apparatus in which the stain of an optical sensor for detecting the presence or absence of the mounting of a toner supplying

container can be reduced as much as possible.

It is another object of the present invention to provide an image forming apparatus in which both of the opening and closing of the shutter of a toner supplying container and the presence or absence of
5 the mounting of the toner supplying container can be detected by an optical sensor.

It is another object of the present invention to provide an image forming apparatus in which is
10 detachably mounted a toner supplying container having a container body for containing a toner therein, a toner discharging port provided in the container body, and a shutter for opening and closing the toner discharging port, and which comprises an interchange
15 door openable and closable for the interchange of the toner supplying container, and an optical sensor provided on the inner surface of the interchange door for detecting the position of the shutter.

It is another object of the present invention
20 to provide an image forming apparatus in which a toner supplying container is detachably mounted and which comprises an interchange door openable and closable for the interchange of the toner supplying container, and an optical sensor provided on the
25 inner surface of the interchange door to detect whether the toner supplying container is mounted.

Further objects of the present invention will

become apparent from the following detailed description when read with reference to the accompanying drawings.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1A and 1B are illustrations of a first embodiment. Fig. 1A is a front view showing a state in which a bottle interchange door is opened. Fig. 1B is a perspective view showing the state in which
10 the bottle interchange door is opened.

Fig. 2 shows a situation immediately before a toner bottle 15 is mounted on the mounting portion of an image forming apparatus.

Fig. 3 is a perspective view of a developing
15 rotary.

Fig. 4 is a schematic view of the toner bottle mounted on the developing rotary.

Figs. 5A and 5B are illustrations of the knob portion of the toner bottle. Fig. 5A is a front view
20 of the toner bottle. Fig. 5B is a perspective view of a portion of the toner bottle.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(First Embodiment)

25 A first embodiment of the present invention will hereinafter be described with reference to Figs. 1A and 1B. The construction of a toner bottle is

substantially similar to the construction described in the foregoing example of the conventional art except the construction of the portion to be detected. Accordingly, the functionally same regions as those
5 in the example of the conventional art are given the same reference characters and need not be described in detail. Figs. 1A and 1B are schematic views of a portion of an image forming apparatus to which the present invention can be applied.

10 The reference numeral 13 designates a bottle interchange door as an openable and closable door openably and closably provided to interchange a toner bottle 15 as a toner supplying container, and the reference numeral 14 denotes a reflection type sensor
15 having a light emitting element and a light receiving element integrally with each other as an optical sensor.

Fig. 1A is a front view showing a state in which the bottle interchange door 13 is opened, and
20 Fig. 1B is a perspective view thereof. The reflection type sensor 14 is installed on the inner surface of the bottle interchange door so as to correspond to the portion to be detected of a bottle knob 1 when the bottle interchange door 13 is
25 pivotally moved in the direction of arrow D and closed.

The construction of the optical sensor is not

restricted to the above-described example, but may be a construction in which the light emitting element and the light receiving element are discrete from each other. In this case, the light receiving
5 element as the optical sensor may be of a construction capable of receiving reflected light from the portion to be detected.

Although described in the foregoing example of the conventional art, the construction of the toner
10 bottle 15 will be described again with reference to Fig. 2 (with reference also to Figs. 5A and 5B as required). Fig. 2 shows a situation immediately before the toner bottle 15 is mounted on the mounting portion of the image forming apparatus. Also, in Fig.
15 2, drive transmitting means 100 alone which will be described later is picked out and depicted as the construction of the image forming apparatus side.

The toner bottle 15 has a bottle body 15A as a container body for containing a toner therein, a
20 toner discharging port (in Fig. 2, closed by a shutter 3 which will be described later) provided in the bottle body 15A, and a shutter 3 for opening and closing the toner discharging port.

Further, the toner bottle 15 is provided with a
25 bottle knob 1 as a rotating member provided for pivotal movement relative to the bottle body 15A. This bottle knob 1 is designed such that at a point

of time before the toner bottle 15 is mounted in the image forming apparatus, a lock portion provided on the bottle knob is locked to the portion to be locked of the bottle body 15A and becomes substantially
5 unrotatable. On the other hand, design is made such that when the toner bottle 15 is mounted in the image forming apparatus, the lock portion of the bottle knob 1 strikes against the image forming apparatus and is displaced, whereby the locking thereof to the
10 portion to be locked of the bottle body 15A is released and the pivotal movement of the bottle knob 1 in a direction B is permitted relative to the bottle body 15A. This construction makes it possible that at this state, a user grasps a grip (a portion
15 on which a reflecting surface 1b is provided as described later in conjunction with Fig.2) of the bottle knob 1 to rotate the bottle knob 1.

The shutter 3 is formed with a gear portion 3A which receives a moving force for opening and closing
20 the toner discharging port.

On the other hand, the bottle knob 1 is also formed with a gear portion 1A (see Fig. 5B).

The gear portion 3A of the shutter 3 and the gear portion 1A of the bottle knob 1 are not drive-
25 connected to each other at a point of time before the toner bottle is mounted in the image forming apparatus.

These two gear portions, however, are designed to be drive-connected to drive transmitting gears 100A and 100B as drive transmitting means 100 disposed on the mounting portion of the image forming apparatus when the toner bottle is mounted in a direction A toward the image forming apparatus. The drive transmitting means 100 has a gear 100C rotatable coaxially with the gear 100A on the back side of the gear 100A, but this gear 100C is hidden behind the gear 100A in Fig. 2.

Accordingly, design is made such that when the gears 100A and 100C are rotated, the gear B which is in meshing relationship with the gear 100C is rotated. That is, the gear 100A and the gear 100B are brought into drive-connected relationship with each other through the gear 100C.

That is, the gear portion 3A of the shutter 3 and the gear portion 1A of the bottle knob 1 are designed to be drive-connected to each other through the drive transmitting means 100 by the toner bottle being mounted in the image forming apparatus.

When in a state in which the gear portion 3A and the gear portion 1A have been drive-connected to each other as described above, the bottle knob is pivotally moved by a predetermined angle in the direction B, a rotating force produced by this pivotal movement of the bottle knob 1 is transmitted

to the gear portion 3A of the shutter 3 through the drive transmitting means 100, and the shutter 3 is moved in a direction X to a position for opening the toner discharging port. The bottle knob 1 being in
5 the thus pivotally moved position is designed to strike against the mounting portion of the image forming apparatus so that the toner bottle may not be drawn out by mistake.

On the other hand, when from this state, the
10 bottle knob 1 is pivotally moved by a predetermined angle in a direction opposite to the direction B, a rotating force produced by this pivotal movement of the bottle knob 1 is transmitted to the gear portion 3A of the shutter 3 through the drive transmitting
15 means 100, and the shutter 3 is moved to a position for closing the toner discharging port in a direction opposite to the direction X.

The toner bottle 15 is designed to be mounted to and detached from the image forming apparatus only
20 when the shutter 3 is in its closed state, that is, only when the bottle knob 1 is in a posture in which it has closed shutter (a posture before mounting).

The toner bottle 15 is also designed to be mounted in the image forming apparatus so as to be
25 substantially unrotatable.

Next, the bottle knob 1 is provided with a reflecting surface 1b as a portion to be detected for

reflecting light emitted from the light emitting
element of the reflection type sensor 14 toward the
light receiving element of the reflection type
optical sensor 14 (has a light-reflecting tape stuck
5 thereon). This reflecting surface 1b is provided on
a surface along a direction perpendicular to a toner
bottle mounting direction A.

This reflection type sensor 14 is designed to
detect that the bottle knob 1 is in a position in
10 which it has been pivotally moved by a predetermined
angle to open the shutter 3. At the same time, this
reflection type sensor 14 also has the function of
detecting whether the toner bottle is mounted in the
image forming apparatus.

15 That is, design is made such that when in a
state in which the bottle knob 1 has closed the
shutter 3, the bottle interchange door is closed, the
light emitted from the light emitting element of the
reflection type sensor 14 to the toner bottle is
20 hardly reflected by the toner bottle and sufficient
light is not incident on the light receiving element
of the reflection type sensor 14.

Also, design is made such that when the bottle
interchange door is closed with the toner bottle not
25 mounted in the image forming apparatus, light emitted
from the reflection type sensor 14 toward a space
(mounting portion) for mounting the toner bottle 15

is hardly reflected by the inner port side of this space and sufficient light is not incident on the light receiving element of the reflection type sensor 14.

5 Accordingly, a CPU as a controller monitors a signal from such a reflection type sensor 14, whereby both of the position of the bottle knob 1, i.e., the opening and closing of the shutter 3, and the presence or absence of the mounting of the toner
10 bottle 15 can be detected. That is, a single optical sensor can perform two different functions and thus, a reduction in the cost of the image forming apparatus can be achieved.

 The reflecting surface 1b is a surface
15 perpendicular to the rotary shaft of the rotary member 51 and also perpendicular to the rotary shaft of the bottle knob 1. These two rotary shafts are parallel to each other and are also parallel to the ground.

20 In whatever operating state the apparatus may be, the reflecting surface 1b is always in a plane perpendicular to the ground.

 By adopting such an arrangement, it is possible to make a construction difficult for the toner adhere
25 to and stain the reflecting surface 1b.

 Further, even if the reflecting surface 1b should be stained, an operator can readily perform

the cleaning of this reflecting surface 1b because of a construction in which the reflecting surface 1b becomes exposed with the opening of the bottle interchange door 13.

5 Also, the optical sensor is provided on the inner surface of the bottle interchange door and even though it is inside the image forming apparatus, it is near to the external portion side and therefore, it is of a construction in which it is difficult for
10 the toner to adhere to and stain it.

 Further, even if a transparent window portion provided so as to cover the light emitting element and light receiving element of the optical sensor should be stained with the toner, the operator can
15 readily perform the cleaning of the reflecting surface 1b because of a construction in which the window portion is opened with the bottle interchange door 13 and the reflecting surface becomes exposed.

 The operating state will now be described.

20 Description will first be made of the user's operation. The following is a normal procedure.

 (1) During the image forming operation, the toner becomes exhausted and image forming is discontinued and therefore, the user is called upon
25 to interchange the toner bottle by a message on the display of the operating portion.

 (2) The user opens the front cover of the

apparatus (not shown), and further opens the bottle interchange door 13.

(3) The user starts to interchange the toner bottle 15 with reference to an interchanging method or the like displayed on the display of the operating
5 portion.

(4) The user rotates the bottle knob 1 by a predetermined angle to thereby release the toner bottle 15 from the rotary member 51.

10 (5) The user draws out the toner bottle 15 toward this side of the apparatus.

(6) The user inserts a new toner bottle 15.

(7) The user rotates the bottle knob 1 by a predetermined angle to thereby fix it.

15 (8) The user closes the bottle interchange door 13.

(9) The user closes the front cover.

Movements in the image forming apparatus corresponding thereto are as follows.

20 (1) When the toner becomes exhausted during the image forming operation, the apparatus discontinues image forming and calls upon the user to interchange the toner bottle 15 by a message or the like to the display of the operating portion.

25 (2) A sensor signal for the opening of the front cover is detected and further, the sensor 14 comes not to receive the reflected light from the

reflecting surface 1b, whereby the opening of the bottle interchange door 13 is detected.

(3) In response to the signal, the display of the operating portion is changed over to the display of an interchange procedure or the like.

(4) to (7) (There is no change during the user's interchanging of the bottle.)

(8) The sensor 14 receives reflected light from the reflecting surface 1b, whereby the closing of the bottle interchange door 13 is detected. In response to the signal, the display of the operating portion is changed over to a display for calling upon the user to close the front cover.

(9) The closing of the front cover is detected, and the display of the operating portion is returned to the ordinary display. The recovery operation is started, and after it is completed, image forming is resumed.

An example of the user's abnormal action will now be described.

(1) The toner becomes exhausted during the image forming operation, and image forming is discontinued and therefore, the user is called upon to interchange the toner bottle 15 by a message on the display of the operating portion.

(2) The user opens the front cover of the apparatus (not shown).

(3) The user, however, becomes aware of having prepared a toner bottle of a wrong color, and again closes the front cover.

(4) The user prepares a right bottle, and
5 again opens the front cover. (Thereafter, the user performs normal action.)

Movements in the image forming apparatus corresponding thereto are as follows.

(1) When the toner becomes exhausted during
10 the image forming operation, the apparatus discontinues image forming, and calls upon the user to interchange the toner bottle 15 by a message or the like to the display of the operating portion.

(2) A sensor signal for the opening of the
15 front cover is detected.

(3) A signal for the closing of the front cover is detected again. There has been no opening-closing detection signal of the bottle interchange door and therefore, the display of the operating
20 portion continues to display the message calling upon the user to interchange the toner. The apparatus neither performs the recovery operation.

(4) (Thereafter, the apparatus performs a normal operation.)

25 As described above, as long as the bottle interchange door 13 is not opened and closed, the display of the operating portion is maintained on

toner interchange display, and an unnecessary recovery operation is not performed.

Consequently, an apparatus friendly to the user can be provided without increasing the cost of the apparatus.

(Second Embodiment)

While the first embodiment is one in which the toner bottle 15 as a toner supplying container is interchanged, the present invention is also applicable to an image forming apparatus of a construction in which a so-called developing cartridge comprising a developing device and a toner supplying container made integral with each other is interchanged. The toner supplying container in the present embodiment, unlike the first embodiment, is for supplying the toner to the developing device.

(Third Embodiment)

While the first embodiment is of a construction in which the toner bottle and the bottle knob are interchanged integrally with each other, in this embodiment, an operating lever as a pivotally movable member corresponding to the bottle knob is provided on the apparatus main body or a developing rotary as a rotary member.

This lever is pivotally moved, whereby the opening and closing of the shutter of the toner bottle are effected. Also, in the case of a process

cartridge, this lever is pivotally moved, whereby the fixing (locking)/the release of fixing thereof to the apparatus is effected. A reflecting surface as a portion to be detected is provided on an end surface
5 of this lever, and an optical sensor is provided on the inner surface of the interchange door so as to correspond to this reflecting surface. Even in such a construction, the toner stain on the optical sensor can be reduced as much as possible, and the cleaning
10 of the optical sensor can be done easily.

As described above, the sensor is far from a portion handling the toner and the detecting surface of the bottle knob is substantially parallel to a vertical direction and therefore, it is difficult for
15 the toner to adhere to and stain the detecting surface. Further, when the detecting surface is stained, it can be cleaned easily if the bottle interchange door is opened, and this leads to a good working property.

20 Also, the sensor can not only detect whether the toner bottle is properly set, but also detect the opened and closed states of the bottle interchange door because a detection signal is operatively associated with the opening and closing of the bottle
25 interchange door. On the basis of the detection signal, a message to the operating portion which is a liquid crystal display portion provided on the upper

portion of the image forming apparatus can be changed over, and fair judgment as to whether the user has interchanged the toner bottle can be passed.

Also, the reflecting surface of the bottle knob
5 is provided on this side with respect to the mounting direction of the bottle, whereby it becomes difficult for the user to touch this reflecting surface when he performs the operation of mounting or dismounting the bottle, and such a problem as faulty reflection
10 attributable to the damaging of the reflecting surface or the stain of the reflecting surface can be prevented.

While in the above-described embodiment, the optical sensor detects the position of the bottle
15 knob to thereby detect the opening and closing of the shutter and the presence or absence of the mounting of the bottle, such an example is not restrictive, but such a construction as will be described next may be adopted. For example, a construction in which a
20 similar reflecting surface 1b is provided on the side edge portion of the shutter and it is detected by the optical sensor can also obtain a similar effect. However, when the cleanability of the reflecting surface 1b is taken into consideration, the
25 construction in which the reflecting surface is provided on the bottle knob is more preferable.

As described above, according to the above-

described embodiment, the toner stains of the sensor and the portion to be detected can be prevented. Also, even if the toner adheres to them, it becomes possible to readily effect the cleaning of them.

5 Further, both of the opening and closing of the shutter and the presence or absence of the mounting of the toner bottle can be detected by a single optical sensor to thereby achieve a reduction in the cost of the image forming apparatus. That is, there
10 can be provided a toner bottle corresponding to such a reduction in the cost of the image forming apparatus.

 The detection of the opened and closed states of the bottle interchange door also becomes possible
15 by this optical sensor and the more simplification of the construction can be achieved.